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ABSTRACT

The introduction and implementation of computer-based learning (CBL) in primary schools in Singapore has created both benefits and problems. This study examined the attitudes and level of anxiety of 77 students toward CBL through two scales, the Computer Programming Anxiety Scale and the Liking for Computer-Related Activities Scale. Results showed a high level of confidence and feelings of adequacy when working with CBL. Only 5 out of 77 students did not feel confident working on computers, and very few indicated worry about performing on the computer in front of peers or the teacher. The students also had a strong liking for computer-related activities: over one-third of the students expressed a strong liking for learning to use programming software and to install a computer, and about half liked to maintain and repair computers and learn how computers are assembled. These attitudes contrast sharply with those of junior college students, who were investigated in an earlier study. (EV)

PRIMARY SCHOOL STUDENTS' ANXIETY AND ATTITUDES TOWARD COMPUTER-BASED LEARNING

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ABSTRACT

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The introduction and implementation of Computer-Based Learning (CBL) in schools in Singapore have made teaching more interesting and effective. The availability and accessibility of technology and information have also provided pupils an enriched experience in learning, especially in emotional and cognitive development. At the same time there are pressing constraints and problems being faced. This paper examines student's anxiety and attitudes toward CBL, the significance of which teachers need to know for a better understanding of the difficulties met by their students in the acquisition of computing competence. An application and evaluation of two validated scales - The Computer Programming Anxiety Scale and The Liking for Computer-Related Activities Scale will be examined as related to CBL. Statistical information on the impact of CBL on pupils from several primary schools will be illustrated.

PRIMARY SCHOOL STUDENTS' ANXIETY AND ATTITUDES TOWARD COMPUTER-BASED LEARNING

The introduction and implementation of computer-based learning (CBL) in schools in Singapore have made teaching a great deal more interesting and at the same time made use of a very different mode of instruction in the classrooms. The availability and accessibility of technology and information have also provided pupils an enriched environment and experience in learning, especially in computing competence and problem solving. However this is accompanied by a host of psychological problems and practical difficulties in the face of numerous changes in the hardware and software area of computer literacy.

One basic concern is the way students perceive their own level of computing competency in problem solving and how this is related to their willingness to attempt to complete the task. When problem tasks involve a lot of mental work such as storage, retrieval and internal manipulation or representations, this often result in a great deal of anxiety and a low self perception in one's ability to succeed in the task. According to Lester et al (1989) when students are convinced that certain types of problems are too difficult for them, they do not even try to solve these problems. They not only lack a ready answer to a difficulty encountered and feeling at a complete loss , they are unwilling to explore the problem on their own.

Perkins etal., (1986) identified two types of psychological reactions when students face anxiety in their computer-based learning environment. The "stoppers" appear to have abandoned all hopes of solving the problem on their own. They feel unsure of what they are doing, harbouring fears about handling the machine and doubting their ability to make the machine do what they want it to do. In a recent doctoral study done by Mooi (1997) the computer to these students has become a threat to one's self-esteem and standing with peers and teachers, even when computer learning can be challenging. The other group of students "the movers" are not easily frustrated when the solution fails the first time and they hold the belief that the problem is solvable. According to Mooi (1997) they may be able to find a solution through experimenting with the problem and making changes.

Students' attitudes and anxiety toward making mistakes and their beliefs of efficacy about computers have a great influence on the decision to use computers. Tobias (1979) indicated how general anxiety can impact indirectly on student learning at different stages of computer instruction. Mandler (1984) reported that a major source of emotion is the

interruption of an individual's plan of action in problem solving. When an interruption occurs, the normal sequence of actions for task completion cannot take place. This causes a physiological arousal of the individual which might result in muscle tension or rapid heartbeat.

Mooi (1997) noted that students affect during problem-solving activities is expected to vary from positive to negative and it is reasonable to assume that a student whose experiences were consistently negative, could develop a negative view of problem solving that would become stable and permanent. Through repetition, the emotional state could become a trait, with the result that the student would always be anxious when confronted with a problem solving task. On the other hand, Prenzel (1988) reported that individuals who develop an interest in computers are more inclined than others to re-engage and persevere in computer tasks with positive feelings. Many students feel very positive about working with computers and persist in the study and use of computers until they develop a fairly high level of computer proficiency (Whitney & Urquhart 1990).

One's attitude towards computers is directly related to one's perceived use of the computer as a beneficial tool. Students who enjoy the challenge of computers, who realise the usefulness and/or value of computers in their education and career plans, are more likely to derive pleasure out of working with computers. What students see as relevant determines what they notice and what they notice are the advantages of working with programs that avoid complexity. Studying how students feel about computer programming and learning would be helpful in determining how computer-based learning can be carried out. Teachers would then be able to provide more positive alternative experiences when necessary. In addition, teachers should pay attention to possible difficulties and take into account students' attitudes and beliefs about the problem as these would interact with the problem solution that would be developed.

PRESENT STUDY - PSYCHOLOGICAL CONCERNS

Two instruments on computing anxiety and liking were validated in a recent study by Mooi (1997). These are the CPAS (Computer Programming Anxiety Scale) and the LCAS (Liking for Computer-related Activities Scale) which were administered to 213 junior college computing students. In the present study the two scales are adapted and given to 77 primary school students being tutored in computer-based learning in their schools.

Computer-Based Learning Anxiety Scale (CBLAS) (see attached)

The 19 statements on the CBLAS are to be responded to with a five point Likert scale ranging from 0 to 4 . This instrument may be completed in ten minutes. Students need

only to circle a number from 0 (never true) to 4 (always true) that best describes how they feel in the scenario depicted by each statement.

Three areas in which anxiety can play an important role have been identified as

1. difficulties encountered in computer-based learning (Errors subscale). The items measure students's state of mind when confronted with errors or difficulties while going through an activity lesson involving the computer.
2. interaction with people (Significant Others subscale). The items measure how troubled and uneasy students are in the presence of more capable computer science students or when they are being assessed by their teachers.
3. confidence or self-efficacy in computer-based lessons. (Confidence subscale). These items measure students' feelings of inadequacy or lack of confidence when working through an activity lesson involving the computer.

Liking for Computer-Related Activities Scale (LCAS) (see attached)

This 24 item attitude scale has also a five point Likert scale. Students were asked to respond to these statements by indicating the extent to which they like each computer activity specified. The degrees of liking vary from not at all to very strongly.

Three subscales were identified:

1. Programming subscale measures students' liking for computer programming activities of an inquiring nature such as learning how to write a computer programme. The mastery of these activities would provide students with a sense of achievement and satisfaction as these activities are cognitively more demanding and require effort and patience.
2. Hardware subscale measures liking for the scientific or technical aspects of computer activities such as discussing computer hardware and assembling parts of a computer. Some of these activities require psychomotor skills.
3. Information subscale is concerned with liking for extra-curricular and people-oriented activities about computers like indulging in conversations on computers and reading about computers. These activities highlight the importance of the computer not only in learning but also as a environmental factor.

This study is based on a sample of primary school students and show some differences in terms of anxiety and liking when compared with the pilot study sample of junior college students in the Mooi study. The junior college students in the computing course have to work through computer programming modules whereas the primary school students are exposed to lessons and class activities based on the computer. Due to this difference, the anxiety level for the junior college students is much higher than the school students'.

The school sample shows a high level of confidence and adequacy when working on lessons involving the use of the computer. In the Confidence subscale it is seldom true for over 65% of the sample that working on the computer during the CBL lesson is a great worry to them. Computers do not make them feel nervous and uncomfortable and only five students out of 77 do not feel confident whenever they work on the computer. Generally, it is only sometimes true for the majority (over 70%) to face difficulties while encountering computer-based learning. Over 50% of them can think properly when they make a mistake during the lesson. They hardly feel tense when they cannot finish their assigned task and they are not troubled by the number of steps in using the software. Only three students out of 77 worry about being picked by the teacher when making mistakes. The majority also interact well with significant others. They are not easily troubled when in the presence of more capable students or when assessed by their teachers.

The findings from the school sample not only present a group of students that is not an anxious lot; they have a high liking for computer-related activities, in particular for programming activities. Over one third expresses a very strong liking for learning to use programming software and to install a computer. About one quarter of them have a desire to find out about the latest computer models. The technical aspects of the computer appeal to them too as about half of the sample like to maintain and repair a computer and to learn how computers are assembled.

The college study done by Mooi (1997) has shown quite different results. Most of the junior college students get worried or troubled when their programmes could not run and when they are unable to find out the reasons. In the interviews conducted in that study, students voiced their frustrations and anxiety in writing computer programs although most of them have a strong interest and liking for programming and information activities. A slightly smaller number have a strong interest and liking for hardware activities but many would like to have an opportunity to learn more about hardware. It is noted that the measure of liking for an activity is directly proportional to the amount of value that the student believes the activity has.

Unlike computer-based learning in the schools, computer programming in the colleges is a regular examination focussed activity. Learning to programme is a key element in the computer course. It involves finding out what programming is for, what the programmes can do, and learning the commands to control the computer in its operations. Much of the anxiety that a student felt are compounded by the student's attempts to handle these all at once. Therefore, some of them become nervous in the presence of their teachers for fear of being picked and appearing foolish in front of their peers if they cannot solve their difficulty or answer the teacher's questions. In most cases, if they encounter any difficulties, they would always prefer to seek help from their friends first.

College level students are older and probably more sensitive to peer pressure and competition than school pupils in these two different studies .The college sample become anxious when their friends could programme and they could not and are in turn troubled by the knowledge and skills of more capable course mates who may sometimes know more than their teacher. They have some liking for computer-related activities, in particular for those related directly to what they were learning in the course curriculum, except for computer programming assignments. Students found it difficult to like doing computer programming assignments, which is compulsory, and would enjoy completing them only if the programming problems are challenging or interesting.

The present study has implied that there are some differences in the structure of the computer or computer-related courses taught in the schools and colleges. Computer anxiety and computer attitudes are related to computer programming ability. School students especially in the high ability group have a more positives programming attitude and computer anxiety may affect not only problem solving skills but also their competence at debugging and programming (which is not included in the courses in the schools) . Any study involving attitudes toward computers and computer-related activities need to explore their influence on computer programming problem solving. Computer programming competence exists in a network of relationships that connect the knowledge domain with problem solving techniques and the affective domain of anxiety and liking.

It is suggested from the school study that a future possible research can focus on how students view their abilities in relation to their peers and the extent of peer influence on facilitating or debilitating anxiety. Students have a sense of accomplishment and conquest when they are able to debug a computer programme, and may become more confident in debugging and solving similar computer programming problems. Students with different computer programming anxiety levels may engage in problem solving with different degrees of perseverance. A future study may measure this increase in confidence and determine its educational significance.

The two instruments (CBLAS and LCAS) in the study have provided teachers one way to measure the performance and traits of students in computer-based or computer related instruction. Replication with different samples may help determine its individual effectiveness and meaningfulness. However, teachers themselves must try to involve students more actively in the process of learning in the computer age. If students enjoy the challenge of computers, realise the usefulness and value of computers in their education and experience low levels of computer anxiety, they are more likely to derive pleasure out of writing computer programmes and working with computers.

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Liking for Computer-Related Activities Scale									
		0	1	2	3	4	Reject	Mean	Std Dev
H	Learning to repair a computer	16	16	12	14	19	0	2.05	
H	Assembling parts of a computer	14	15	22	9	17	0	2.00	
H	Learning to maintain a computer	1	12	18	22	24	0	2.73	
H	Learning how computers are assembled	12	15	15	18	17	0	2.17	
H	Discussing computer hardware	12	19	18	16	12	0	1.96	
								2.18	0.31
I	Reading computer magazines	15	17	22	17	6	0	1.77	
I	Talking with friends about computers	7	22	17	23	8	0	2.04	
I	Listening to friends talking about computers	11	18	15	24	8	1	1.97	
I	Going to computer shops	12	16	20	13	16	0	2.06	
I	Learning debugging techniques	5	12	21	23	16	0	2.43	
I	Going to computer exhibitions	17	8	17	20	15	0	2.10	
I	Finding out about latest computer models	7	12	20	19	19	0	2.40	
I	Buying books on computers	17	17	29	8	6	0	1.60	
I	Collecting computer brochures	12	17	15	18	15	0	2.09	
I	Reading books about computers	19	22	16	17	3	0	1.52	
								2.00	0.30
P	Learning the principles of programming languages	6	21	24	14	12	0	2.06	
P	Learning how to write computer programmes	10	13	28	9	17	0	2.13	
P	Learning to use programming software	1	4	17	29	25	1	2.92	
P	Discussing computer software	7	19	18	21	11	1	2.10	
P	Learning different programming languages	7	16	20	16	18	0	2.29	
P	Learning to install a computer	4	11	18	19	24	1	2.60	
P	Doing computer programming assignments	4	16	21	26	10	0	2.29	
P	Debugging computer programmes	10	12	18	22	15	0	2.26	
P	Learning to use utilities software	11	13	16	19	18	0	2.26	
								2.32	0.27
	Overall Liking for Computer-Related Activities Scale							1.79	0.32

H Hardware Subscale
I Information Subscale
P Programming Subscale

LIKING for COMPUTER-RELATED ACTIVITIES SCALE (LCAS)

Computer-Based Learning (CBL) anxiety Scale									
		0	1	2	3	4	Reject	Mean	Std Dev
C	I do not feel confident whenever I work on the computer	31	20	15	6	5	0	1.14	
C	Computers make me feel nervous and uncomfortable	39	20	13	4	1	0	0.81	
C	Working on the computer during the CBL lesson is a great worry to me	47	25	3	1	1	0	0.49	
C	I think I would not be able to understand how the computer software works	24	29	15	5	4	0	1.17	
								0.90	0.32
E	My mind seems to be confused with so many computer terms	18	28	19	6	6	0	1.40	
E	I cannot think properly when I make a mistake during my CBL lesson	30	27	13	6	1	0	0.97	
E	I feel tense when I cannot finish the assigned task for the CBL lesson	23	17	24	10	3	0	1.39	
E	I feel tense whenever I make mistakes during the CBL lesson	28	19	20	8	2	0	1.18	
E	I am troubled by the number of steps in using the software	15	34	14	10	4	0	1.40	
E	If my program cannot run I do not know what to do next	15	25	21	7	8	1	1.56	
E	It worries me when my program cannot run	17	25	20	9	6	0	1.51	
E	It worries me that my teacher knows I do not learn from the software during the CBL lesson	30	22	17	8	0	0	1.04	
E	As the information in the CBL lesson become more complicated I feel that I cannot concentrate	26	16	23	8	4	0	1.32	
E	My mind seems to go blank when I cannot solve a problem during my CBL Lesson	24	26	15	9	3	0	1.23	
E	I worry about being picked by my teachers when I make mistakes during the CBL lessons	26	18	20	10	3	0	1.30	
								1.30	0.18
O	I feel nervous in the presence of more capable students	24	15	22	8	8	0	1.49	
O	I feel troubled when my friends know how to handle the computer and I could not	21	23	21	6	6	0	1.39	
O	I worry about making a fool of myself in front of my friends when I don't know how to run the software	36	16	14	4	7	0	1.09	
O	I am troubled when friends discuss some software features that I do not understand	20	22	20	11	4	0	1.44	
								0.36	0.18
	Overall Computer-Based Learning (CBL) anxiety Scale							1.23	0.27

C Confidence Subscale
E Errors Subscale
O Significant Others Subscale

COMPUTER-BASED LEARNING ANXIETY SCALE (CBLAS)

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